

## Teaching of Statistics in Social Sciences Through E-Learning

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**Abstract:** *This paper focuses on the organization and content of social interactions in a group of University of Lyon 2 students engaged in an e-learning situation dealing with statistical concepts. The importance of social interactions in the teaching and learning has been informed by socio-constructivist theories. We examined observable traces of micro-level exchanges between students engaged in a complex e-learning task, noting technical constraints and spatio-temporal characteristics that influence course participants engaged in a social organization established to achieve a common goal. To do this we used both quantitative and qualitative analyses of messages exchanged on a participant discussion forum. Statistics education in an online, distance, collaborative group situation is a new framework for learning. The mechanism of teaching and learning based on collaborative work through the observable traces of online social interactions was explored. The main focus of our study was to discover what occurs when students attempt to learn Statistics without face-to-face meetings with their classmates and their teacher. Our data show that in this online course, students took keen interest in the topic and enhanced their learning. We believe that this online mode of teaching statistics, even though lacking in face-to-face interactions, should be implemented on a wider scale since it has the potential to provide more opportunities for interactions irrespective of geographical boundaries.*

**Key Words:** *Teaching statistics, statistical concepts, online teaching, online learning, e-learning, social interactions, socio-constructivist.*

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### 1. Introduction

Rapidly increasing information communication technologies, specifically for teaching at the higher education level, has customized traditional models of information exchange with new and novel learning environments. The Internet provides easy and quick access to users around the globe. It not only minimizes geographical distances but also provides a virtual platform for collaboration and learning (Levy, 1997; Quéau, 2000). It links individuals or groups who would otherwise be separated geographically. This, in turn, has affected educational settings to the point where it also affects the social interactions of learners (Pradeau, 2009). Training institutions now are able to extend their services to this new environment by offering online distance learning courses (Wallet, 2007). The use of Internet has driven media and practices from static pages to dynamic pages, where the concept of interaction is being redefined. A student is no longer a mere spectator but an actor, interacting with other users and exchanging data of all kinds (Wolton, 2000).

The importance of a social dimension in learning has been informed by socio-constructivist theories. This work done in the 1970s and 1980s on the concept of socio-cognitive conflict highlighted the social dimension

of interactions in an individual's cognitive development (Perret-Clermont, 1986). Goffman (1988) defined social interaction as "any occasion when an individual comes forward for responding to another, whether by physical co-presence, by telephonic call or by exchange of letters". Social interaction establishes the connection between the "micro" and "macro," postulating that the study of interactions among a small group can model society as a whole (Winkin, 2001).

Goffman (1973) also focused on concept of the team, which he defined as a set of people whose close cooperation is essential for maintaining and explaining a situation, an interdependent relationship created among members to trust each other so that their conduct maintains an interactional order. Thus, the commitment of each team member is required to maintain intellectual and emotional attention, mobilizing psychological resources for the purpose of official interaction (Nizet & Rigaux, 2005).

Technical progress is accompanied by a change in social practices, especially with the proliferation of social networks. The social practices of students are gradually modified by this digital media. Units such as place, time, and social interaction that characterize the traditional classroom need to be redefined (Glikman, 2002). Learners located in different geographical locations, can gather and study together in the same virtual space, in a forum for discussion where there is a virtual place for social interaction that is characterized by written and structured communication (Mangenot, 2008).

Despite the proliferation of videos and pictures on the Web, the text written in the common language of learners remains a central concern for both digital campuses and the entire education sector. The structure and quality of these written interactions allowed us to track the process as well as take into account student learning. Indeed, these online collaborative practices are quite different from those experienced in face-to-face meetings, requiring adaptation on the part of individual actor/participants. Working and learning in groups involves mobilizing a number of social skills needed to advance the achievement of the task which is likely to grow throughout the collaborative process (Simeone, Eneau & Rinck., 2007).

The major mode of communication is written, eliminating indices of socio-emotional behavior (sight, posture, voice) that would be present in a face-to-face relationship. The written information, often condensed, might be considered "cold," and thus should be "humanely warmed" (Tholozan, 2004). The use of specific codes, such as emoticons (*smileys*) or writing in capital letters can strengthen the connection and give the message an emotional tone, facilitating interpretation of the text. This mode of communication adds a new dimension to time, since most online work is done on discussion forums or via e-mail, asynchronous modes of communication. These messages recorded in digital format can be replayed later and serve as a memory archive for the group of learners, available at any time.

Traditional teaching involves the physical presence of co-actors: teachers and learners in the same place. In online training, physical proximity may be absent, or occur in a time-free manner. This experience changes the perception of the co-actors. The "sense of presence" is perceived differently by different individuals since "the physical presence is a dimension of presence and there is a range of presences that range from total absence to co-presence" (Jacquinot-Delaunay, 2001). The concept of distance is primarily a mental construct, a feeling, probably on the same order as the concept of presence. A learner's difficulty in pursuing a university degree at a distance is compensated for by e-learning's providing an interactive medium (Béziat & Wallet, 2007). Becoming visible and audible at a distance is a way to incarnate oneself in the cyberspace. Remote interaction, therefore, requires various means of conveying the signs of one's presence (Weissberg, 2001). This enhanced sense of presence is probably necessary to overcome the interactive solitudes and perhaps limit the number of dropouts, especially important for distance learning (Wolton, 2000).

An interest in social organization, particularly in the context of distance and online university education led researchers to explore the relationships among students working in groups as part of a course at Master degree level in Education at digital campus, where they were studying statistical concepts and techniques. The main objectives of our research were to explore the mechanism of this social interaction and the ways of progressing without the immediate physical co-presence of participants who had the intention to learn

statistics. It began with the assumption that interactions are rich and structured and that technical and spatio-temporal constraints have effects on social practices. More generally it can be said that the question of working in groups to learn statistics was updated by the proliferation of virtual learning spaces. This research was designed to pay attention at the micro level to the small social unit organized in the specific context of online collaborative learning. The study of social dimensions in the teaching-learning process is crucial, since it permeates the whole training process.

## 2. Method and procedure

The method of this study was to conduct a naturalistic observation of recorded messages on a forum used by a group of Master of Education students involved in collaborative work for their training and assessment who were enrolled at the campus FORSE (Formations et Ressources en Sciences de l'Éducation) at the University of Lyon, Lyon 2-France, and who were using a digital platform for course "Research Methods and Statistics". Data were extracted from their written communications during their session 2006-07.

For this study, the students were randomly divided into eight sub-groups, each comprised of six students. A manual explaining the goals and intended outcomes of this course was given to the students and discussed with them by the tutor of the course in the first course meeting. Students' work was to be evaluated and integrated into the overall assessment for their obtaining of the Master in Education degree. The main objective of the course was to provide training to participants in the domain of Research Methods and Statistics. To achieve this objective, we utilized a common theme: "Academic Success and Reasons to Implement Statistical Tools". The researchers divided this theme into four sub-themes:

- Academic achievement and family environment
- Academic achievement and gender
- Academic achievement and team teaching
- Academic achievement and social class.

For this study the researchers adopted a multifaceted methodological approach:

- *Deductive inquiry*: scrutinize structured and ritualized online interactions
- *Inductive reasoning*: consider implications of participants' interaction
- *Adductive approach*: consider participants' *creative intuition/insight* (phenomena that seemed surprising (Peirce, 2006).)

In research on ICT, the inductive approach is primarily used for the observation of participants' practices and actions performed during the training (Wallet, 2002). Studies of digital forums have the advantage that data are extracted from the written evidences left on the platform without disrupting participants' use of the forum. These traces of communication are helpful for researchers in understanding the interactions of the group members and their facilitators (Bruillard, 2005, 2008).

The researchers considered and examined written messages on discussion forum as evidence of social interactions without the physical co-presence of students. This type of data allowed an approximation of data by observation and content analysis (Blanchet, Gione, Massonnat, & Trognon, 2000). This form of observation eliminated the effects that could be induced by the presence of the observers in a physical situation. From another point of view, the files carrying the traces of exchanges via digital connections were documents that could be analyzed by documentary analysis techniques. The corpus built and analyzed consisted of messages exchanged by six group members participating in collaborative work within the selected course. The confidentiality and encryption of data were made by assigning fictitious names (*i.e* A, B, C, D, E, F) to interactants working together. The messages received on the forum were also coded as "Mn" where n was the number of messages on the forum. In order to identify the meaning of the message content, and to assess them from an evolutionary aspect, an observation was conducted during three periods of a thematic unit (Bardin, 2007). Each observation took place over a period of eight days, in the beginning, middle, and end of the session (sub-corpus P1, P2 and P3). For each sub-corpus the corresponding coding

units of meaning was presented in a matrix of raw data to reveal the presence or absence of an element in a descriptive and comparative way.

### 3. Results

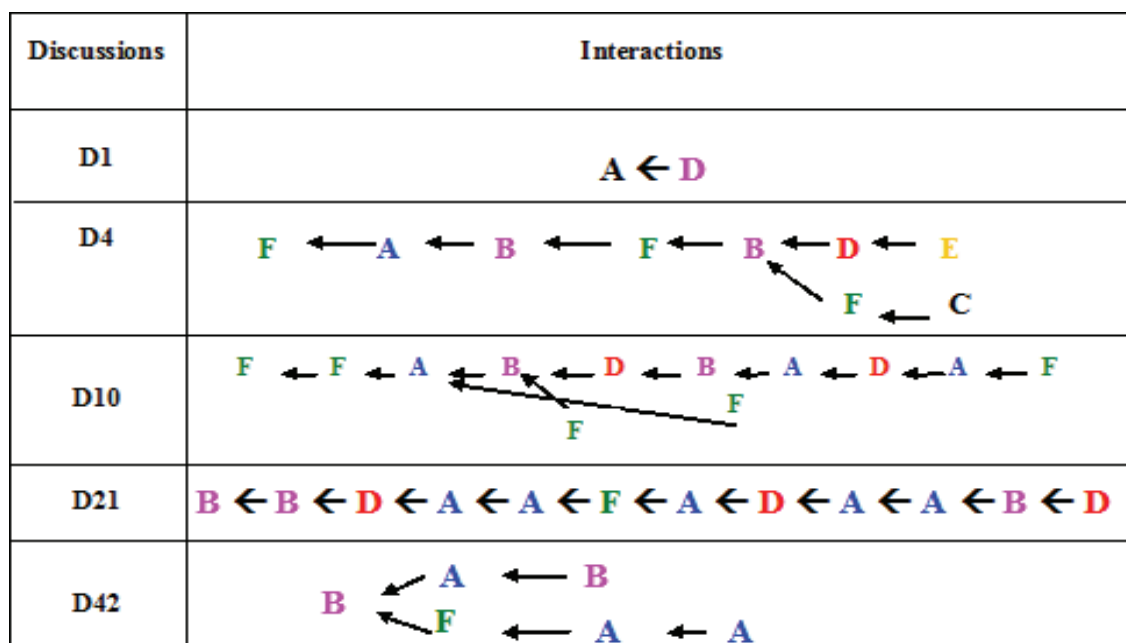
The collaborative work session took place over a period of six and half months (199 days) from September to April. The observation of data helped to make the following observations.

The data consisted of three hundred thirty nine messages, eight of which were filed by three students (*i.e.* G, H & I) from outside the study group. The number of messages submitted by each student reveals a wide disparity (Table 1).

**Table 1** Number of messages submitted by students

Students	A	B	C	D	E	F	G	H	I
Number of messages	114	66	11	47	46	47	5	2	1

In most cases, the action of filing a message triggers another action in the same mode, namely the issue of a new message. Of the 339 messages, 259 were answers to messages, more than three-quarters (76%) of the initial corpus. The messages did not always answer the first message, but might have been a response to another reply. Fifty-six discussions were executed among the participants, something that we believe would not be possible in a face-to-face situation. There were 14 discussions between two people, with at least three messages in strictly linear pattern. There were 24 and 18 discussions with at least three nonlinear messages but none came close to a circular pattern or demonstrated a very complex mode. A schematic presentation of communication showed a linear pattern of interaction (Figure 1).



**Figure 1:** Schematic presentation of interactions

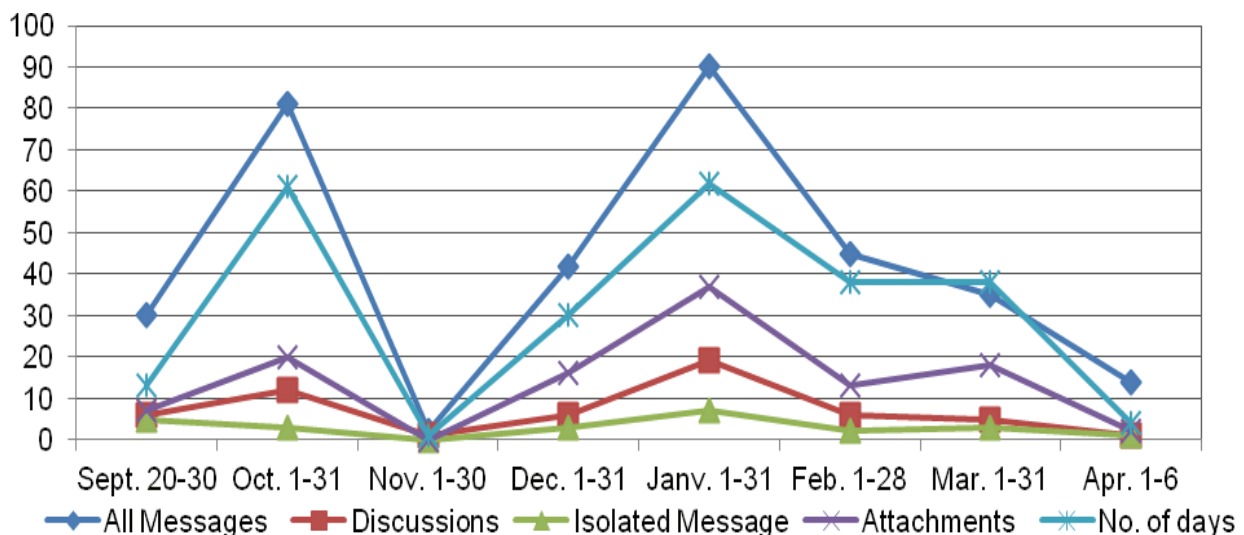
The messages discussed are represented chronologically from left to right. For example, in discussion 1 (D1), D replies to A. Out of three hundred thirty-nine messages, one hundred ten, almost one third of the data, contained an attachment. These attachments were usually files containing data related to collaborative

work. By sharing these files group members were sharing their documents, discoveries, questions, and advanced work. This technological possibility helped participants in the learning process by contributing to a rapid exchange of knowledge.

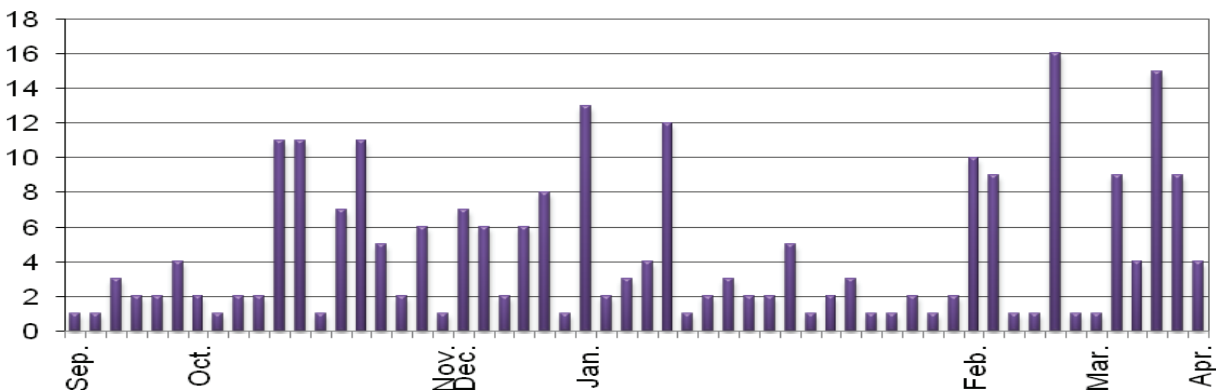
The researchers also discovered a trend of participants sending isolated messages that were not the part of academic discussion. These messages contained such things as calling for the attention of someone or an invitation for a phone call or chat.

The time elapse among interactions was long, considering that a face-to-face exchange takes place in the immediate time. A typical strand on the forum took between a few minutes to several days. The modal value was 16 days, and extreme variability was found over the months. The average for the whole session was 4 days per discussion. For a period of one month (between November 7 and December 6), no messages were deposited on the forum (Figure 2 & 3).

There were visible actions such as sending messages, responding to messages, and filing attachments, all of which highlighted spatio-temporal issues. The evidences of these observable actions were archived to constitute the corpus for analysis. We found the structure of messages and discussions to be significant. Some messages remained unanswered; some were very structured and engaged the participants. The number of visible interactions varied widely during the session, with periods of intense activity (mid-October and mid-January) where all available participants on the forum were simultaneously involved (Figure 3). In many situations the sender specified the recipient, either in the salutation or in the body of message.

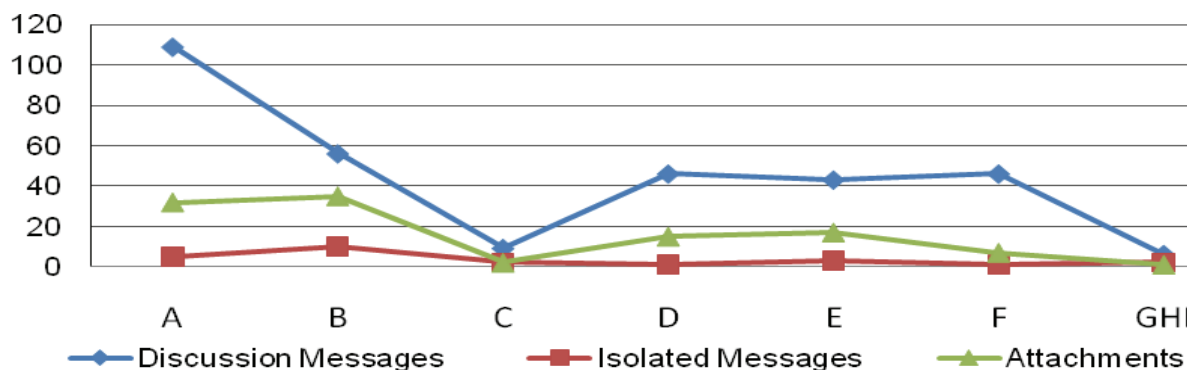


**Figure 2:** Trend of activities during the training session



**Figure 3:** Month wise number of days per discussion

The analysis of the rate of posting a message on the forum showed that among members, student A posted the maximum number of discussion messages followed by B. Other students participated almost at the same rate except for student C. Student B attached more files with his or her message as compared to others. The external students participated at a negligible rate (Figure 4).



**Figure 4:** Student wise activities

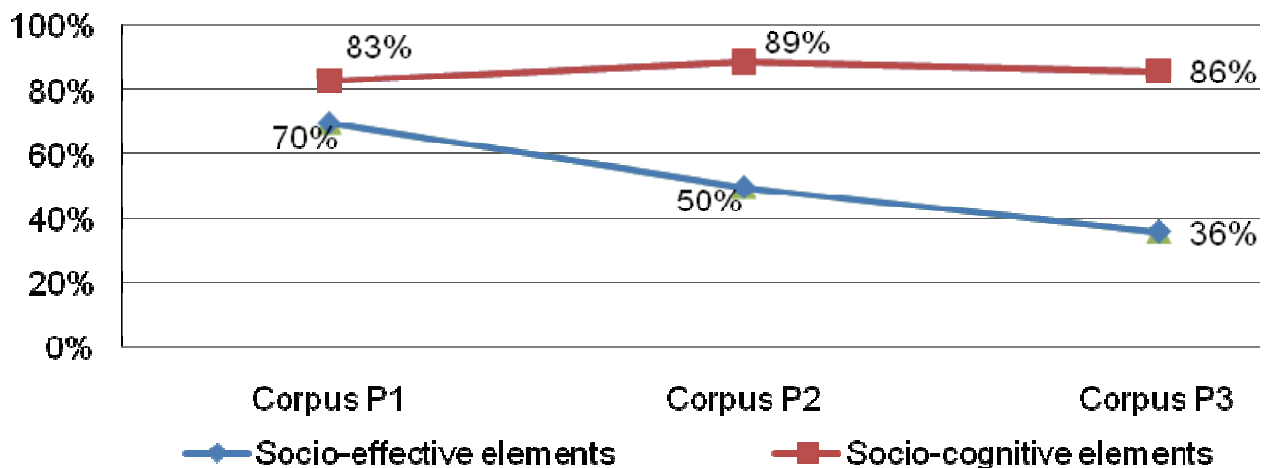
A significant variation is seen with regard to the length of the messages. For example, the shortest message was just a single word: "here", along with an attachment. The longest message was a considerable 626 words. This was a message posted by a student C after a long absence. We interpret this as a way he/she attempted to rectify his/her absence by writing a single 626-word message that could be considered an exchange repaire. While in face-to-face interactions, this "wordiness" could be considered a monopoly of speech, this does not seem to be the case in e-learning. This type of written transmission seemed acceptable in the context of digitized collective work.

Message content was very diverse: greetings, exchange of knowledge regarding course content, technical or organizational information, and references to external events (chats, phone calls, personal life, etc.) often using emoticons that gave messages a significant emotional tone.

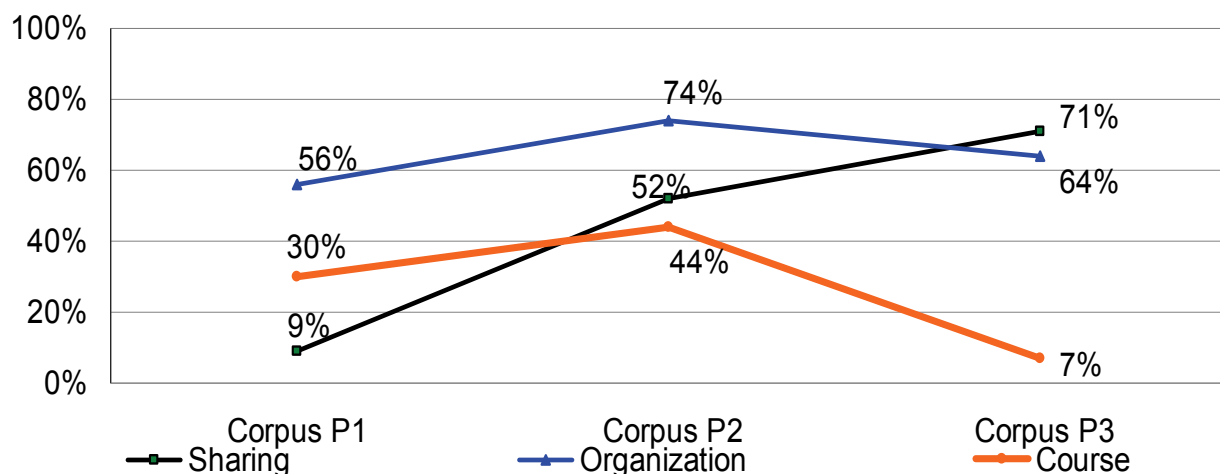
The message originator whose subject line was "Here" was attempting to define a common workplace in a digital campus. The references to areas outside the study forum (place, chat, or telephone appointments) remained consistent during the first two corpora: three messages in P1, five messages in P2, none in P3). The third corpus was less significant because it represents the final phase of the session, where the extent of communication appeared less necessary in terms of work performed. This diversity of "places of exchange" suggests that interactions between students are not restricted to visible actions on the forum.

The content analysis of messages in the three phases of collaborative work showed a strong presence of socio-emotional elements in 70% of messages early in the course. However, this then declined consistently (Figure 5). Units of meaning to socio-cognitive connotations were found in 83% of messages in corpus P1 with a small growing change in P2 and then declined in P3. This high rate of socio-cognitive elements during the whole session appears directly linked to notions of collaborative work and online learning. Indeed, the task to be performed, which was at a distance, required multiple interactions in terms of building knowledge and methodological organization. These socio-emotional elements, present in very early discourse, probably constituted unity in the working group. These exchanges, which are trademarks of familiarity, contributed to group cohesion and the formation of the team, thereby facilitating the conduct of the task.





**Figure 5:** Advancement in content of the messages



**Figure 6:** Concepts contained in socio-cognitive

In further observation, a distribution of units of meaning to socio-cognitive characteristics in the messages was obtained (Figure 6). Exchanges showing units of meaning concerning the organization of collaborative work were the most representative and remained almost constant during the module. The development of a complex group at a distance requires strong coordination throughout the process. The graph of units of meaning referring to the concept of sharing is strongly upward. Students shared their findings or issues, fueling the process of learning both individually and collectively (Perret-Clermont, 1986). The traced messages however, made little reference to the course content as would be expected. Online communication linked to the sharing aspect seemed essential in promoting cohesiveness in the group. The sense of organization also increased among group members in achieving the common goal set by the teacher of the course.

#### 4. Conclusions

The digitized traces of the six students' actions confirm the presence and richness of highly structured interactions. On the forum designed for online communication students worked together. The structure of the forum impacted interactions, which themselves determined the social experiment conducted by the actions. This structure, steeped in technological aspects, influenced participants and their perceptions. Despite this, very few students outside the group intervened (only eight messages). The content analysis of messages

highlighted the significant number of references to areas other than the forums. These were produced in the course module at the initiative of some students.

As part of their online collaborative work students were engaged in conducting a joint project, a collective production with a specific deadline. There was also a strong challenge for students since part of the collaborative work led to products involved in their final evaluation. Hence it can be considered that there must have been a relationship of interdependence between group members. Each team member respected the order of interaction by his/her partners, implying a certain level of commitment, *i.e.* an emotional and intellectual attention to the official purpose of interaction (Winkin, 1981). Students were linked by a common purpose and a form of intimacy was established in the team. A minimum level of participation seemed implicitly recognized as essential by all. Each member of the group showed a part of him/herself by his/her actions and communications. This part of self that was exposed at distance occurred mainly through writing, contrary to what is observed in face-to-face situations (Le Breton, 2004).

This approach allows micro-sociology to pay attention to what is happening in a small social unit in a specific online collaborative learning context, where thematic analysis verified the presence of strong socio-emotional and socio-cognitive factors. The cognitive aspects were more prominent because of the context of interaction: Collaboration on an academic project. The actions of participants were constrained by the technical structure of the forum, but also impacted by a form of interactional order. The social reality of the collaborative working group observed was constantly reshaped by the actions of its members. The study of social dimensions in distance education is essentially linked with teaching and learning and is central, as addressed in socio-constructivist theories. The complexity of such research remains consistent (Henry, Peraya & Charlier, 2007) and involves leaving the usual frame of reference, which has already been heavily influenced by the digital revolution.

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